DOCUMENT RESUME

ED 259 785 JC 850 417

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TITLE Science Mastery: A Design for High-Risk Student Success.
INSTITUTION Midlands Technical Coll., Columbia, SC.
PUB DATE [84]
NOTE 9p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Developmental Studies Programs; *High Risk Students; Mastery Learning; Program Descriptions; *Remedial Instruction; *Science Instruction; Two Year Colleges

ABSTRACT

Midlands Technical College has developed a model for a developmental science program which offers assistance to students through a three-phase "spanning for success" approach in which the transition from developmental to curriculum course work is gradual; and the developmental instructor works closely with the student from the time that s/he enrolls in developmental science until s/he successfully completes his/her mainstream science course. Though open to all science students, the developmental science program is designed for students who are enrolled in programs for which anatomy, chemistry, or physics is a requirement, but who did not take the course in high school; took it but were not successful; or feel the need for background preparation in science. The program operates through developmental, transitional, and spanning for success phases, which begin as well-ordered, tightly structured mastery learning experiences, proceed to more independent developmental instruction and auditing experiences in mainstream courses, and conclude with mainstream class enrollment supplemented with tutorial assistance. Evaluation studies indicate that the program has increased student success in mainstream science courses and increased student persistence in college, as well as providing other benefits for students and faculty. (AYC)

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SCIENCE MASTERY:

A DESIGN FOR HIGH-RISK STUDENT SUCCESS

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SCIENCE MASTERY: A DESIGN FOR HIGH-RISK STUDENT SUCCESS

Underprepared students, including those enrolling in anatomy, chemistry and physics courses, need more than simple remedial assistance. According to Dr. Robert H. McCabe, "Methods must be established for additional support service coordinated with course work (McCabe, 1982-83, p.9)." A model for a developmental science program offered at Midlands Technical College in Columbia, S.C., offers assistance to students through a three-phase "spanning for success" approach in which the transition from developmental to curriculum course work is gradual; the developmental instructor works closely with the student from the time that he enrolls in developmental science until he successfully completes his mainstream science course. The implementation of this model has paid off through measurable evidence of student achievement and retention.

TARGET POPULATION

The Developmental Science Program is open to all science students, but deals mainly with traditional high-risk students: adult students, returning students, first-generation college students, students who have not previously been successful in school, and minority students. It is designed primarily to serve students who are enrolled in programs for which either anatomy, chemistry or physics is a requirement, but who:

1. did not take this course in high school,
2. took it, but were not successful,
3. are returning adults who feel the need for background preparation in science.

The program therefore has three main tracks: anatomy, chemistry and physics, and the student can enroll in one or all of these, depending on his particular graduation requirements. The purpose of the program is to enable the student to take and pass the matching mainstream anatomy, chemistry or physics course with a grade of "C" or better.

MAIN FEATURES

There are two main features of the Developmental Science Program:

1. First, it is based on a tight working network between the developmental science instructors and the mainstream science instructors. It is this network which has influenced the direction and design of the program.
2. A second feature of the program is that it operates in a pleasant, relaxed atmosphere. The general impression is more that of a library than of a traditional science classroom, for the students study in a carpeted, well-lighted room that has round study tables and upholstered chairs. The color-coordinated carpet and chairs are bright and cheerful.

PROGRAM DESIGN

A close look at the program reveals that it has three distinct phases; as he moves from Phase 1 to Phase 3 of the program, the student gradually moves from being totally a developmental science student to enrollment in and completion of the matching mainstream science course.

PHASE 1: DEVELOPMENTAL. The student enters the developmental science program on the basis of his high-school transcript. During the first phase, which approximates his first quarter of enrollment, the student works according to a prescription that includes a working schedule and planned completion dates. The student has input into this prescription because he helps to plan the schedule and the dates for completion.

The program operates under the assumption that developmental students initially need and respond best to a highly structured learning environment. Therefore the environment for a Phase 1 student is well-ordered and tightly structured. The instructors use in-house developed materials that are based on mastery learning; each lesson has a pre-test, specific objectives, learning activities to accomplish these objectives, a self-test and a post-

test. Students are required to make at least 85% on the post-test before moving to the next lesson and there are provisions for routing the student systematically from step to step within a lesson and from lesson to lesson within the course. Allowances are made in each lesson for active student participation in the learning experience and for frequent student feedback and positive reinforcement. Although most of the instruction at this point is one-to-one, there are also frequent small group discussions, small group lectures, and laboratory demonstrations.

PHASE 2: TRANSITION. During the second quarter of his enrollment, in Developmental Science, the student is gradually moved away from the tightly structured environment of Phase 1. At this point, Phase 2, the instructor makes a deliberate attempt to challenge the student and move him to higher levels of development. The student is now approaching the end of his prescription in the self-paced materials. During Phase 1, he worked on these materials in class, but now he is encouraged to do this work at home, using the class time to ask questions and take tests. Thus, the student now begins to take responsibility for his own learning.

During Phase 2, the tight bond between the developmental science and the mainstream science instructors comes into play, for the developmental science instructor meets with the mainstream instructor and works out a schedule for the student to begin auditing portions of the mainstream course. The student therefore begins to attend selected class lectures for the mainstream course; he participates in the class activities, takes notes, and attends the laboratory sessions. At the same time, he reports back to his developmental instructor on a regularly scheduled basis, to discuss what he is learning in the mainstream class. The developmental instructor then explains the material that the student did not understand, questions him deeply about what he has heard in class, and asks challenging questions about the course material. The developmental instructor instructor also goes through the class notes with the student and is able to give

direct pointers on effective note-taking. If the student so chooses, he can even take tests along with the mainstream class and the developmental instructor will review the test with him.

During Phase 2, the developmental instructor begins to ask fewer knowledge or rote-memory types of questions. Instead, the questions require the student to demonstrate that he can apply or analyze knowledge learned, interpret data or descriptions, and synthesize solutions. The questions also sometimes require the student to hypothesize what might happen in a given situation, to make inferences, or to apply what he has learned in a different context (Hofwalt, 1984, p. 54). Questioning during Phase 2 is again a part of the deliberate attempt to move the student to higher levels of development.

PHASE 3: SPANNING FOR SUCCESS. At the beginning of the third quarter, the student enrolls in the mainstream science class for which he was preparing. Thus he begins Phase 3 and at this point he has done the following:

1. He has completed his prescription in the self-paced materials and has therefore acquired the basic entering knowledge needed for success in the course.
2. He has attended portions of the mainstream class and is already familiar with the instructor, the materials and the instructional techniques that will be used.

Phase 3 is actually a tutorial linkage in which his developmental science instructor now acts as his tutor; the tutorial linkage is so tight that the student actually views both the mainstream course instructor and the developmental science instructor as his course instructors. One is in charge of the regular class lectures and laboratory sessions; the other is available on a regularly scheduled basis for tutorial assistance and guidance. The tutorial linkage is open, not just to developmental science students, but to all students who are enrolled in the mainstream course. The developmental students are expected to attend the tutorial sessions, however. All students who are interested in in receiving tutorial assistance from the developmental science instructor,

including the developmental science students, are given a schedule for this on the first day of class. Phase 3, the tutorial linkage component, is free for all full-time students, but part-timers are charged a per quarter-hour fee.

BENEFITS

The three phases of student progress in developmental science mean that the instruction for success in the mainstream science course is both PRIOR TO and CONCURRENT WITH the student's enrollment in the mainstream course. The tutorial linkage component has brought about a full integration of developmental science with the mainstream courses in anatomy, chemistry and physics as well as a tight bond between the developmental and mainstream science instructors. Since the tutorial linkage is open to all students, both developmental and non-developmental students are seeking assistance from the learning laboratory--a step that has taken away much of the stigma that was formerly associated with developmental studies. Some of the other benefits of the Developmental Science Program have been these:

1. There has been a meshing of the entry level skills for anatomy, chemistry physics with the developmental science exit skills. The tutorial linkage component means that the developmental instructor is working closely with the student while that student is actually enrolled in the mainstream course. The developmental instructor is therefore acutely aware of the skills that the student needs in order to be successful in the course.
2. The strong networking system between the developmental and mainstream science instructors means that there is a lot of interaction between these two groups. Not only is the developmental instructor more aware of course content, the mainstream instructor is more aware of the difficulties and obstacles faced by high-risk students. The mainstream instructors have therefore become more responsive to the needs of high-risk students.
3. As was mentioned before, the tutorial linkage component - Phase 3 - has centralized the developmental science program by opening the learning laboratories to all

science students.

4. Continuing to offer instruction and assistance to developmental students <u>after</u> they have enrolled in the mainstream course has cut down on the amount of time that the student needs to spend initially in developmental studies. The tutorial linkage allows the student to get on with the business of getting through school; he does not need to spend so much time in work that is prior to his enrollment in the mainstream course.
5. The linkage program also allows for a gradual weaning process. Before the addition of Phase 3, developmental students who had completed their work in developmental studies and enrolled in a mainstream class were literally stunned by the difference between the highly personalized self-paced atmosphere of developmental studies and the more competitive pace of the traditional lecture class. The three-phase system of the Developmental Science Program allows the student to move <u>gradually</u> from the self-paced, highly structured environment to the traditional lecture format.

EVALUATION RESULTS

Evaluation studies indicated that the three-phase Developmental Science Program has (1) increased student success in mainstream science courses and (2) increased student persistence in college.

(1) <u>STUDENT SUCCESS</u>. Studies of 360 students over a three-quarter period reveal that 79.5% of the former developmental science students passed the mainstream science course while 57% of the non-developmental science students <u>in the same mainstream science course</u> passed.

(2) <u>STUDENT PERSISTENCE IN COLLEGE</u>. Apparently "Success Breeds Success," for these studies also show that students who participate in the Developmental Science Program tend to enroll for subsequent courses in greater numbers than do the science students who did not enroll in Developmental Science.

The Developmental Science Program has made the study of science and science-

based programs more accessible to high-risk students, students who have traditionally been under-represented in these programs. This three-phase program can be used as a model, not just for developmental science, but for developmental programs in math, English and other areas as well.

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AUGUST 30, 1985